Clean Hydrogen Partnership

Topics in the call 2022

Renewable Hydrogen Production

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EUROPEAN PARTNERSHIP

Renewable Hydrogen Production Overview

Main Focus

- Cost reduction and efficiency increase for renewable hydrogen production routes:
  - New LT and HT electrolyser designs for high pressure operation
  - Larger cell electrolyser stacks
  - Large scale electrolysers in industry, off-grid and offshore
  - Improved efficiency solar thermochemical H2 production.

What is new

- Circularity
- Improved electrolyser manufacturing

Co-funded by the European Union

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Renewable Hydrogen Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022 -**01-01:** Development and validation of pressurised high temperature steam electrolysis stacks (Solid Oxide Electrolysis)	RIA	2.5	31/05/2022
HORIZON-JTI-CLEANH2-2022 -**01-02**: Development and validation of pressurised high temperature steam electrolysis stacks (Proton Conducting Ceramic Electrolysis)	RIA	2.5	31/05/2022
HORIZON-JTI-CLEANH2-2022 -**01-03**: Development of low temperature water electrolysers for highly pressurised hydrogen production	RIA	2 x 2.5	31/05/2022
HORIZON-JTI-CLEANH2-2022 -**01-04**: Design for advanced and scalable manufacturing of electrolysers	RIA	2 x 2	20/09/2022
HORIZON-JTI-CLEANH2-2022 -**01-05**: Scaling up of cells and stacks for large electrolysers	RIA	6	20/09/2022
HORIZON-JTI-CLEANH2-2022-**01-06**: Efficiency boost of solar thermochemical water splitting	RIA	4	31/05/2022

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Renewable Hydrogen Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-**01-07**: Bringing renewable hydrogen MW scale off-grid installations closer to technical and financial maturity	IA	9	31/05/2022
HORIZON-JTI-CLEANH2-2022-**01-08**: Integration of multi-MW electrolysers in industrial applications	IA	18	20/09/2022
HORIZON-JTI-CLEANH2-2022-**01-09**: Scaling-up technologies for SOEL	RIA	2 x 3	31/05/2022
HORIZON-JTI-CLEANH2-2022-**01-10**: Demonstrating offshore production of renewable hydrogen	IA	20	20/09/2022

Renewable Hydrogen - Topics

HORIZON-JTI-CLEANH2-2022 -01-01: Development and validation of pressurised high temperature steam electrolysis stacks (Solid Oxide Electrolysis)

Game changer SOELs

- Stack design for >5 bar , >10kW, > 2,000 hours, current density 0.85 A/cm2 - check degradation
- CAPEX< 2,000 €/(kg/d), electricity consumption < 39kWh/kgH2 for 9kWh/kgH2 of heat input
- circularity by design for materials

HORIZON-JTI-CLEANH2-2022-01-02: Development and validation of pressurised high temperature steam electrolysis stacks (Proton Conducting Ceramic Electrolysis)

Game changer PCCELs

- Stack design for >5 bar, >5kW > 2,000 hours, current density 0.5 A/cm2 - check degradation
- CAPEX< 2,000 €/(kg/d), Faradaic efficiency > 90%
- circularity by design for materials

Renewable Hydrogen - Topics

HORIZON-JTI-CLEANH2-2022-01-03: Development of low temperature water electrolysers for highly pressurised hydrogen production

LTELs for gas grid injection and avoidance of mechanical compressors

- Pressure > 50 bar for AEL & AEMEL and > 80 bar for PEMEL, Temp < 150°C
- >50kW AEL & PEMEL, >25kW AEMEL (larger cell areas)
- Efficiency increase by 2-4% (LHV) compared to the use of a mechanical compressor
- Breakthroughs in stack design, materials, cell components

HORIZON-JTI-CLEANH2-2022-01-04: Design for advanced and scalable manufacturing of electrolysers

Novel component(s) or manufacturing process(es) integrated in a demonstrator stack

- New surface coating technologies and advanced manufacturing processes (e.g., 3D printing)
- Improvement of manufacturing throughput and level of automation to produce a stack, reduced manufacturing times and costs
- Consortia should include > 1 electrolyser OEM, one actor from the manufacturing sector and > 1 SME
- Explore synergies with Made in Europe partnership (Cluster 7).

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HORIZON-JTI-CLEANH2-2022-01-05: Scaling up of cells and stacks for large electrolysers

Design & construct cells to test the viability of building a single 10MW stack

- Scale-up of cell active areas by > 2x, higher current densities
- Appropriately scale-up BoP, ensure compact design, minimise weight and footprint
- Build and test several short stacks, identifying optimal sizes for larger cells and stacks from scientific, engineering, logistics and economic perspectives.

HORIZON-JTI-CLEANH2-2022-01-06: Efficiency boost of solar thermochemical water splitting

Solar thermochemical cycles as a viable and competitive hydrogen production technology

- Solar to H2 efficiency > 10% - 0.75 kg/year per m2 land area used for solar concentration factor of 1,000
- H2 production cost < 5 €/kg
- On-sun operation of 50-300kW plant for 6 months
- Seek collaboration with EIC Pathfinder Challenge projects

Renewable Hydrogen - Topics

HORIZON-JTI-CLEANH2-2022-01-07: Bringing renewable hydrogen MW scale off grid installations closer to technical and financial maturity

Demonstrate complete value chain of off-grid hydrogen production, storage and end-use installations at MW scale

- Direct coupling of 3-5 MW-scale RES and H2 production installations – potential changes in RES technologies
- Highly flexible electrolyser with suitable BoP and coupled to electricity storage
- Eligible costs along the value chain

HORIZON-JTI-CLEANH2-2022-01-08: Integration of multi-MW electrolysers in industrial applications

Demonstrate electrolyser technologies beyond state-of-the-art in a specific industrial application

- >25MW electrolyser, LT or HT
- Possible innovations: possibly supply two customers; use of O2 and heat; grid services; footprint reduction
- Includes a go-no go decision, then 2-year operation
- Investigate synergies with Process4Planet or Clean Steel Partnerships

Renewable Hydrogen - Topics

HORIZON-JTI-CLEANH2-2022-01-09: Scaling-up technologies for SOEL

Scalability of cells, stacks and modules, in terms of design, manufacturing & assembly into modules;

- Optimal stack assembly layout into modules of > 250 kW capacity– build downscaled module of at least 80 kW
- Footprint < 150 m²/MW, current density > 0.85 A/cm² , degradation < 1%/1,000 hours;
- Operate for > 2,000h
- Demonstrate appropriate production methods

HORIZON-JTI-CLEANH2-2022-01-10: Demonstrating offshore production of renewable hydrogen

Design, construct and integrate a > 5MW electrolyser in an offshore infrastructure

- Re-use existing offshore oil/gas infrastructure or develop new – export wind energy as H2
- Safety aspects, remote control, autonomous operation, inspection & maintenance
- Design, construction & 2 years operation, assessment of performance (degradation, OPEX and maintenance costs), economic viability of using existing offshore infrastructure or building new